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The Stryt Issa dairy herd at grass

Profitable Milk Production in North-east Wales

F. W. Keighley

STRYT ISSA FARM, Penyfford, near Chester, was purchased in 1965 by Mr. D. C. Shore on his move from a smaller farm a few miles away. It consists of 83 acres of land lying within a ring fence at about 300 ft above sea level with a rainfall of 30 in. per year. Apart from 15 acres of peaty riverside meadows which are liable to flooding, the soil is light and free draining and there are no poaching problems unless the weather is exceptionally wet.

Farm policy

The farm's economy is based on milk production from a herd of pedigree Friesian dairy cows. All the heifer calves born are reared for dairy herd replacements and herd expansion. The objective is to have a high level of individual performance coupled with a high stocking rate and at the same time to make the maximum use of grass and grassland products.

Buildings and labour

Silage is made in an 8-bay Dutch barn with shuttered concrete walls and the cows are housed in cubicles in a lean-to building alongside. The herd is milked through a 5–10 herringbone parlour into a 500-gallon bulk tank. One unusual feature of the parlour is that there is a movable feed hopper, used for dispensing rolled barley, in addition to the conventional fixed hoppers for dairy nuts. This enables two types of supplementary feed to be given in the parlour and concentrate feeding can consequently be more closely geared to silage quality. Slurry is removed and spread daily. The buildings have been laid out to make the tasks of managing, milking and feeding the dairy herd as labour saving as possible and this enables Mr. Shore and his son to run the farm on their own, apart from some casual help at busy periods.

Dairy herd

In 1970/71 the herd consisted of sixty-two dairy cows together with eighty-one head of young dairy stock. On the 83 forage acres at Stryt Issa, together with 23 acres of accommodation land taken for summer grazing, a stocking rate of 0·94 forage acres per grazing livestock unit was achieved.

Most of the herd calves during the period August–March; calvings in the April-July period are avoided if at all possible. Extensive use has been made of nominated bulls over the years and this has contributed towards a steady improvement in milk yields:

Year ended	Gallons sold per cow
31st March 1970	1,123
31st March 1971	1,178
31st December 1971	1,203

In recent years, the herd has consisted of 30–40 per cent of heifers, due to a policy of hard culling and increasing the dairy herd size. Total solids are in the 12·5 per cent to 12·6 per cent range and the calving interval is currently about 380 days.

The heifers are reared to calve at 22–24 months of age with grass, silage and rolled barley forming the major part of the diet after three months of age. So that they can become accustomed to dairy herd conditions prior to calving, the in-calf and bulling heifers are housed in cubicles and are fed on self-feed silage during the winter period. Consequently there are no problems with cubicle refusers and the heifers are able to compete effectively with cows at the silage face when they enter the herd.

In most years the dairy herd is out to grass by the end of March or early April, and initially they graze round the mowing fields once or twice before these are shut up for silage. After this, the cows go to a paddock grazing system, consisting of half day paddocks, for the rest of the grazing season. The only exception to this is if grass growth is retarded due to dry conditions, in which case the cows graze round the cutting area until the paddocks have recovered sufficiently.

A small amount of rolled barley is fed to the cows during the grazing season but this amounts to no more than 2–3 lb per cow per day as a carrier for minerals.

Young, leafy wilted grass prior to picking up

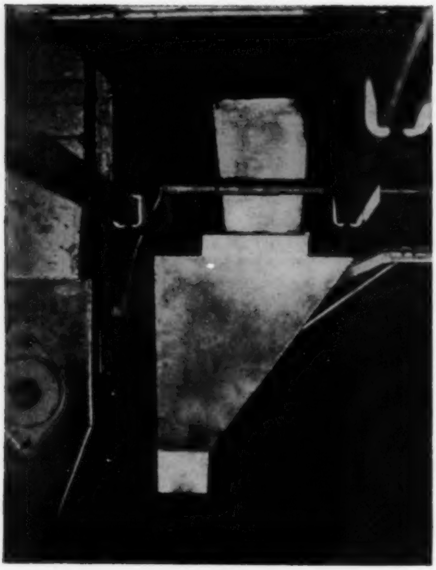
Grassland management

The management of the grassland is based on two factors:

1. The grass must be grown quickly; and
2. whether it be grazed or conserved, the grass should be used at or about 21–24 day intervals, except during periods when growth is slow.

The grassland on the farm is based on perennial ryegrass leys which stay down for as long as they are productive. Conventional methods of reseeding have, in the past, resulted in many stones being brought to the surface; these have had to be removed manually. To overcome this, in 1971 two fields were successfully reseeded using a paraquat/direct drilling technique. The old swards were sprayed twice with paraquat at about 10-day intervals at the rate of four pints and two pints per acre in fifty gallons of water. This high rate of paraquat application was to ensure a satisfactory kill of self sown cocksfoot in the sward and the high water rate to ensure the maximum penetration of the spray material. Three cwt per acre of a compound fertilizer was applied and the seeds were drilled at a 5 in. spacing and then a second time on the diagonal.

Except for direct reseeding, no phosphate or potash has been applied for the past three years and soil analysis shows there has been no deterioration in the phosphate and potash status. This is because all the slurry produced is immediately returned to the land. On grazing areas, nitrogen is used at the rate of 60–70 units per acre prior to turn out in the spring and then at the rate of 40 units for subsequent grazings. On fields to be mown for silage, 100 units of nitrogen per acre are applied before the first and second cuts and 60–70 units prior to the third and fourth cuts. Overall nitrogen usage is 300–350 units per acre, depending on the season.



Movable barley hopper in parlour

Silage making and feeding

After grazing by the dairy cows, the mowing fields are progressively shut up from late April, 100 units of nitrogen per acre are applied and silage making commences on or about the 20th May.

The grass is cut using a five foot flail mower and allowed to wilt for 12–48 hours, depending on the weather, during which period it is turned. It is then picked up by a 48 in. in-line forage harvester and blown into a trailer pulled directly behind it. The harvester is set slightly lower than the flail mower so that there is a clean pick-up of material. A rear-mounted buck rake puts the grass into the silo which is made on the wedge system so that there is as small a working area as possible. This, coupled with sheeting down at the end of each day's filling and the fact that the mass concrete walls are air tight, means that very little air gets into the silage, so cutting visible waste down to negligible proportions and helping to ensure a good fermentation.

Depending on the season, either three or four cuts are made annually by this method. Each cut is very similar in analysis and there is little or no variation in cow performance in moving from one cut to another. The material is self-fed behind tombstone barriers. The analysis of the silage made in 1971 was as follows:

	First Cut	Second Cut	Third Cut	Fourth Cut	Average for North Wales
Dry matter (%)	30·8	32·6	40·4	30·4	23·8
Crude Protein (%)	28·4	32·4	25·3	24·2	13·9
MAD Fibre (%)	26·4	30·0	28·9	30·4	38·4
pH	4·5	5·2	4·9	4·7	4·4
Estimated SE	60·0	55·0	59·0	55·0	44·0
Estimated DCP	18·9	21·6	19·8	18·7	8·4

The silage is very much above average in quality and in the winter of 1971/72

maintenance and two gallons of milk was being obtained from it with the next four gallons from mineralized barley fed at the rate of 4 lb per gallon.

Profitability

The following table shows the physical and financial performance of the dairy herd in 1970/71:

Yield per cow	1,178 gallons
Concentrates fed per cow	24 cwt
Concentrates fed per gallon	2·28 lb
Milk sales per cow	£205
Cost of concentrates per cow	£41
Margin over concentrates per cow	£164
Stocking rate (per livestock unit)	0·94 acres
Fertilizer cost per acre	£7
Margin, milk sales over concentrates and fertilizer costs per acre	£166

Currently (January 1972) with higher milk yields and the better price obtained per gallon, coupled with lower concentrate costs per ton, last year's margin over concentrates has been improved on considerably and is now £191 per cow.

Summary

It was stated earlier that the overall farm policy was to combine a high level of individual performance with a high stocking rate and the figures indicate that this is being achieved with a high degree of success.

So far as the grassland management is concerned, the herbage is used, whether for grazing or for conservation, at its optimum quality so that high yields can be obtained with a minimum input of supplementary feed. Concentrates are used only when the cows' yield is in excess of what the grass or silage can provide.

Future policy

Mr. Shore has recently purchased a neighbouring farm, primarily for rearing dairy herd replacements and for dry cows. This will enable the dairy herd at Stryt Issa Farm to be increased to the 100-cow level.

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Points from selected papers presented at the Oxford Farming Conference:

Husbandry — the Key to Profit

S. R. O'Hanlon

NOT the least of the aspirations associated with post-war farming was the idea of that perennial forum in 'the sweet city of dreaming spires', the Oxford Farming Conference, which has now been assessing, probing and criticizing farming theory and practice for a quarter of a century. Over that period it has invited to its platform such a cavalcade of eminent, hard-hitting and constructive speakers as to make it a premier occasion in the farming calendar. It was appropriate, therefore, that Lord Walston should devote his long and well-researched paper to the evolution and change in farming systems since 1945 and evaluate their significance in economic, technical and social terms against the next twenty-five years.

Twenty-five years

In historical perspective Lord Walston saw the wide-ranging changes which have marked Britain's agriculture in the post-war period as comparable with the effects of the enclosure movement and the introduction of the four-course rotation. Against a background of unrelenting economic pressures, higher capitalization and a dissolving labour force, the engineer, chemist and plant breeder have produced the means of a sophisticated husbandry by which, as Lord Walston said, 'the net result is cleaner farms, healthier crops, rotations which would have made our fathers turn in their graves (and even make some of us turn before we get to ours), a minimum of cultivations, a fraction of the former expenditure on labour for cleaning, and an entirely new and heavy cost for materials'. The former emphasis on mixed farming has declined as increasing specialization has become the hub around which the farming philosophy of the 1970s revolves. But a high degree of specialization and cutting of corners can have dangerous effects, Lord Walston added—'difficulties which we are only just beginning to realize and which, if ignored, may present far greater difficulties in the future'. This apprehension, explicit or implied, was to recur in the papers of other speakers. 'The spread of wild oats would not be so severe if less corn were grown and if there were enough hands to pull them before they got a real foothold' said Lord Walston. 'There would be less mildew if barley were grown less frequently. And soil structure would present few problems if leys followed corn, muck was spread once during the rotation and, perhaps most important on clay soils, heavy machinery did not go on the land when it was wet.'

On the social side, village life has undergone a profound change. 'Not only

is farming no longer the main support of the community' he said, 'but many of the people who live in the country are no longer innate countrymen.' The speaker highlighted the loss in the farm labour force when he compared the 1,078,000 employed in 1946 with the 430,000 twenty years later, and continued 'what in many ways is more significant and far more frightening for the future is that the composition of the age groups has greatly changed . . . Farming is already an occupation largely of the middle-aged; in another twenty-five years, if no radical change takes place, it will be an occupation for the elderly'.

Greater emphasis, Lord Walston believes, will in the future be placed on quality in crops and on varieties tailor-made for mechanical handling. He thinks, too, that before long plant breeders will provide an early ripening maize which could so usefully play a part in arable rotations. In animal husbandry he expects automation to increasingly facilitate feeding and remove the chores of cleaning up; more attention will be paid to breeding for disease resistance, and considerable changes in animal feeding, including the use of synthetics, are in prospect. The emphasis here—endorsed by nearly every other speaker—was on grass, 'the crop that grows best in Britain', as he put it. And he pointed also to large specialist arable farms which could with advantage carry a considerable head of livestock.

Grass—the supreme break crop

Mr. D. J. Marshall, who farms 300 acres in East Lothian, is a ley enthusiast. As such, his message to the Conference was that grass is the supreme break crop and that its benefits far outweigh its problems. Under circumstances where economic pressures have meant the abandonment of fixed rotations and most arable farms are growing a high percentage of cereals with break crops of variable frequency, he invited his audience to consider the pros and cons of moving to a rotation where grass and livestock would be the backbone of the farming system without using a large proportion of the farm. Primarily, he saw the grass break as being more profitable than cereals and increasing the yields of succeeding crops by adding organic matter and improving soil structure. Grass and livestock can be used to greater advantage where there is a variety of enterprises. True, the system demands more capital for the animals themselves and perhaps for buildings, fences and grass machinery; but, then, what new enterprise does not? Equally, arable cropping is capable of being adjusted annually, while with livestock it takes longer to change course and reach an optimum degree of intensity—factors which have to be weighed in the balance of personal optimism.

Finally, considering Britain's entry into Europe, Mr. Marshall drew attention to the potential beef and lamb market on our doorstep. 'There is a world shortage of beef, he said, 'and it is estimated that it will take ten years for the enlarged Community to become self-sufficient, and this does not allow for an increase due to rising living standards. In the Six at the moment lamb consumption per head is one-tenth of the figure for Britain and there is surely a sales promotion future there.'

Grass and good husbandry

The importance of grass in today's concept of husbandry was also the subject of Dr. P. D. Quayle's paper, which he opened by defining husbandry as 'the alternation of crops and stock in such a way as to promote the well-being of the land. It has nothing basically to do with profit, and our problem

is to arrange husbandry in such a way as to be compatible with profit. In a few favoured areas', he said, 'husbandry and profit go easily together, but for the great majority of arable farmers the only possible alternative to cereal production is growing grass, and it is interesting to speculate why farmers have not accepted grass as a suitable break crop to cereals in many parts of the country. One sees plenty of evidence of this: soils which have lost their structure, fields so thick with wild oats that one cannot see the crop, the presence of perennial weeds and the absence of fences. These and many other signs of bad husbandry are plain for all to see'. In Dr. Quayle's view any land which is ploughable should be subject to rotation in the same way as beet or potatoes, even if this only means ploughing and reseeding every ten years. He held that though clearly farmers must get the best return on capital, etc., for most of them the limits must be set by good husbandry and adopted in the long-term understanding as being the best which farming can offer.

Accepting that for the generality of farmers grassland is an ingredient of good husbandry, it is vital that the *in situ* use of the crop on lowlands be realized to the full. Conservation losses, approximating probably to 40 per cent in our haymaking and 20 per cent in silage-making, must obviously be reduced. 'Grass utilization has been the Achilles heel for many farmers', said Dr. Quayle. '. . . Apart from the problems of capitalizing livestock, buildings to house them and silos to feed them, it is very difficult to apply 400 units of nitrogen to grass and to graze it efficiently. Our most successful graziers are not using more than 300 units . . . and if the deliveries of fertilizer are any guide to usage, the actual amount used is well below 100 units over the country as a whole.'

What is good husbandry?

It was predictable that someone would come out with this 64,000-dollar question, and Mr. Gavin Catto did so in the concluding paper. The answer to that question has varied over centuries of farming conduct, as the relative importance of crops and stock, supply of capital, security and current economic conditions have dictated. Neither is the question easy to answer in the diversity of farming conditions to be found in this country. But if there is no handy blueprint, certain fundamental practices are acknowledged as being necessary to maintain, indeed increase, the fertility of the farmer's basic raw material—the soil.

Mr. Catto put drainage at the top of his list, since all other factors are cancelled out if drainage is bad. In the same vein he stressed the need for continued good cultivations. 'So great has been the change in techniques over the past few decades, that one doubts if the plough as we know it today will continue in use' he said. 'The use of herbicides has made the problem of weeds less dependent on cultivations, and in recent years there has been a tendency to play down the necessity for what is loosely described as a good tilth. Modern herbicides have revolutionized our cropping patterns, but they are not a panacea, and it is obvious that weeds like couch grass and wild oats are not going to give in except to a *combination* of good, sound cultivations and the use of the appropriate herbicide at the right time'.

Looking at the near-monoculture of barley growing practised in some areas, the speaker conceded it may have been due to the economics of the times or that the capital cost of equipping for a reasonable grain acreage had driven some farmers into a greater acreage simply to justify the cost. Nevertheless,

he contended that there is nothing more than a small part of our arable land which would not benefit from an occasional break from cereals. 'Pressures of cash cropping have made grass a side issue at least and in some cases it is even looked on as a nuisance. But times change and, with some confidence created by current livestock prices, we could see a renewed and increasing interest in grassland. We must exploit to the full all the short cuts in hauling food to, and dung away from, livestock'—costly perhaps in providing a better layout of buildings and mechanical feeding, but essential nowadays if a good stockman is to be kept happy; and, said Mr. Catto, there is a real need to highlight the great contribution which our good farm workers make to good husbandry.

The shades of Walter of Henley, Fitzherbert and Thomas Tusser may or may not have been present in the Town Hall, Oxford, but the tenets of good husbandry, which incidentally have always furnished the key to profit in the long run, were seen still to be of concern in a farming world far removed from their simple understanding.

A copy of the full proceedings of the Conference may be obtained from Mr. M. H. R. Soper, O.B.E., Dept. of Agricultural Science, University of Oxford, Parks Road, Oxford, OX1 3PF, price 80p, post free.

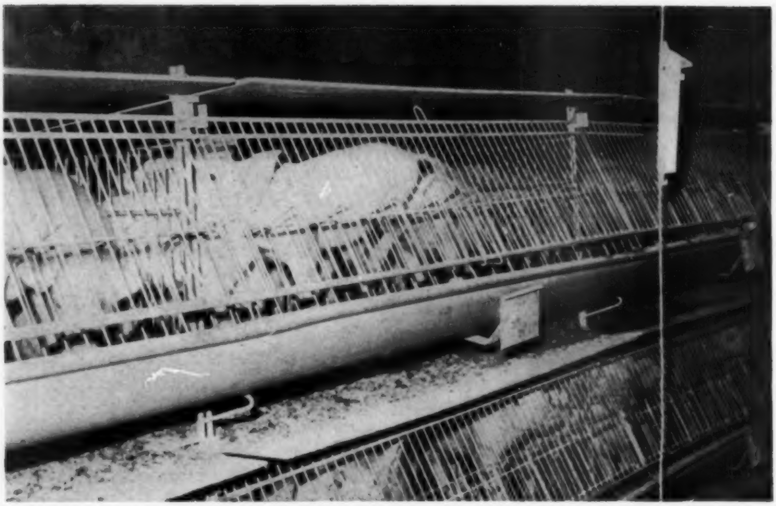
Swine Fever—an Assessment of the Value of Eradication

Swine fever was eradicated from Great Britain on 27th June, 1966, after the successful completion of an eradication policy which was introduced on 10th March, 1963. During this period 415,947 pigs were slaughtered and £5,681,700 was paid to pig owners in compensation. Since that time the country has remained free from the disease, with the exception of three small related outbreaks in Yorkshire in July, 1971. This notable achievement has received world-wide acclaim as an example of disease eradication.

The value of eradication has been assessed by an independent worker, Mr. P. R. Ellis, M.P.H., B.Sc., M.R.C.V.S., of the Department of Agriculture, University of Reading. His work has recently been published under the title *An Economic Evaluation of the Swine Fever Eradication Programme in Great Britain* *.

This work gives a very comprehensive cost/benefit analysis and takes into account all quantifiable aspects of swine fever. Mr. Ellis concludes that the total cost of the eradication programme, including compensation, ancillary expenditure and the cost of maintaining disease surveillance during the period 1963 to 1965, was £12·3 million. But this is far outweighed by the benefit of eradication, which he estimates at £37·5 million for the same period. This figure does not include many unquantifiable benefits which are of great additional value; these include reduced suffering to pigs, improved food conversion, freedom from restrictions, an easier diagnosis of other herd disease problems, the expansion of herds and intensive systems, greatly improved export potential, and a disease climate that allowed the introduction of a national Pig Health Scheme.

**Copies can be obtained from the Department of Agriculture, University of Reading, price £1·25.*



26-week-old pigs, removed on day photograph taken. Note solid floors and accumulation of manure over 3-week rearing period

Cage Rearing Early Weaned Pigs

P. L. Scudamore

PIGS are being weaned progressively earlier as technological advances afford better environment and suitable feeds. The development of creep feed pellets made it possible for the change from eight to six and then to three week weaning. Now further developments begin to make weaning at a week or less possible on a commercial scale.

Experimental work in the cage rearing of very early weaned pigs has shown that they can be reared successfully on solid food from approximately 48-hours old. In practice weaning at five days onwards on a specialist pig unit makes it possible to remove pigs from the farrowing quarters, enabling high cost specialized buildings to be used to greater advantage. Piglets in these early stages require a comparatively small area, so they can be kept in tiers of cages. In this way the maximum use of controlled environment heated rooms can be made.

The advantages claimed for this system by two farmers in Yorkshire, where additional buildings are needed for expansion, are:

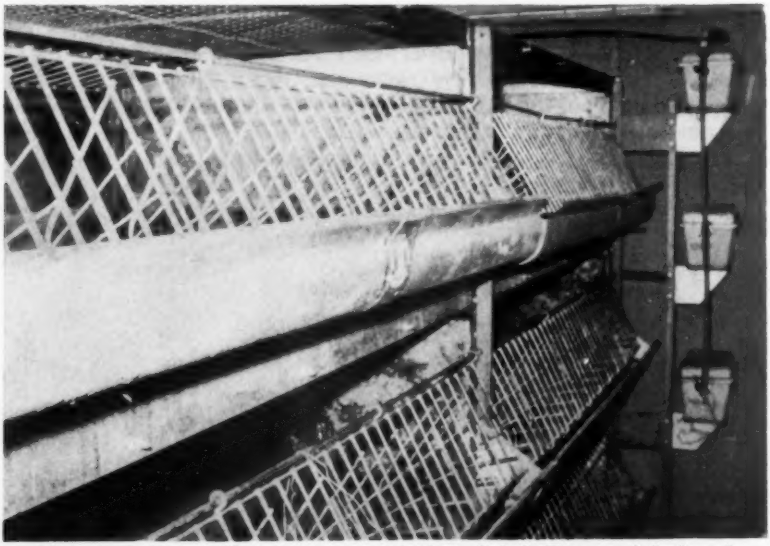
1. An economic method of expansion.
2. Less fighting between piglets.
3. Rearing of piglets of even size in a batch.
4. Good growth rates.
5. Low mortality.
6. Reduction of sow feed costs.
7. Ease of management.

A 50-sow unit

On one farm at Salton, a herd of forty-seven sows has been built up; the target is to carry a herd of fifty sows, selling weaners. Buildings were extremely limited and to make the maximum use of them batch farrowing was organized. Sows move from tethered stalls in old cow byres to tethered farrowing pens, also in converted byres. The costs of alteration were kept to a minimum, so for rearing purposes three sows and litters were grouped together at about ten days in straw baled kennels in yards. As the herd increased, as so often happens, it was found that the pressure on the available accommodation and management again became evident, so further buildings became necessary to ensure that efficiency in production would be maintained during the expansion.

After considering such factors as costs, systems and convenience, it was decided to select a cage rearing system and to erect a kennel-type fattening house with mesh dunging area. These provided the farrowing and rearing space needed as well as for the second stage of fattening about half the pigs to bacon.

The cage rearing unit comprises a package deal house with two rooms and a central service area. Each room is fully insulated and has its own ventilation and heating system, enabling full control of the environment required by the pigs according to their age and weight. The cages in each room are stocked to capacity and there is no further introduction of younger pigs to those already established in the cages.



Three tiers of cages with separate water tanks for each deck. Floors are belt cleaned

In this unit the cages have mesh floors beneath which is a movable belt for cleaning, so arranged that the urine runs clear of the lower decks. The belt floor is cleaned after the first week, twice in the second week and daily afterwards, by winding from one end and discharging into a plastic bin.

A small header tank is situated close to each tier to maintain the water at

A controlled environment house to accomodate 120 pigs

ambient temperature; this is piped to two nipple drinkers in each cage. Troughs are replenished with dry food pellets 2–3 times a day as necessary. The objective is for the piglets to be introduced into the cages at twelve days of age, at which time they weigh between 7 and 9 lb, where they will stay for four weeks. In the first week the temperature, regulated by a thermostat, is maintained at about 28°C and reduced in the second week to 26°C and then to about 24°C in the third and fourth weeks.

It is necessary to keep the pigs in a dimmed light to reduce their activity and prevent fighting. Dimmed light conditions for part of the day is not dissimilar to sty or some other kennel-type systems of rearing. The piglets after birth are treated as in most intensive systems, that is iron injections at two or three days, castration and teeth cutting at about three days; but in addition the tails are half docked on about the third day.

The building when fully occupied will hold 120 pigs. Allowing for cleaning, the theoretical use could be twelve times per year with a throughput of 1,440 pigs. Total cost of the building and equipment is about £1,200 gross, of which £480 is invested in the cages.

The feeding regime is based on intensive rearing pellets. The method practised is that No. 1 Pellets (26 per cent protein) are introduced as a creep feed at about two days old while the piglets are suckling. This is continued when the pigs are moved into the cages and until they are about three weeks old. From then until about five weeks No. 2 Pellets (21 per cent protein) are used with no particular changeover procedure as this is found to be unnecessary. The method of change of feed is that 1 cwt of No. 1 Pellets are used for twenty pigs and then changed to No. 2 Pellets. Super-grower Pellets (18 per cent protein) are gradually introduced into the feed at about four and a half weeks, the full changeover being completed by the sixth week.

The piglets are moved directly from the cages to the fattening house, initially at thirty per pen. On entry the pigs weigh 32 lb on average, and when

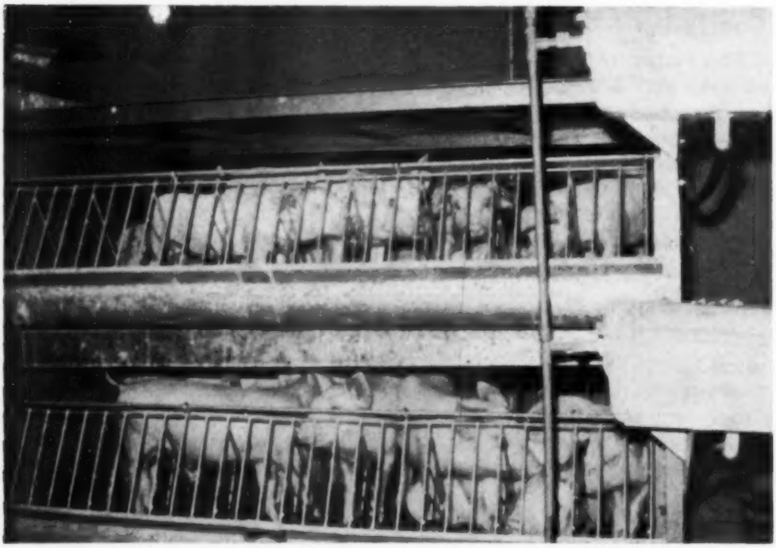
they reach about 60 lb are split into two pens each of fifteen. Pigs are taken to light bacon weight, 175–187 lb liveweight. When the first four reach the lower weight they are removed, which relieves the pressure on the animals remaining in the pen.

At weaning, the piglets are moved to the cages and the sows to tethered stalls, where the food is withheld for twenty-four hours. Feed to the sows is restored to about 5 lb over the next two days. At the time this article was written sows were served at 21–27 days after farrowing and only one break of service had occurred with the three batches which had passed through the system.

A 200-sow example

On a second farm, near York, where approximately 200 sows are kept for the sale of weaner pigs, the cage rearing system was selected as a method of expansion and to maintain the high standard of management. The objective is to farrow in batches of ten in crates and move the piglets into cages at five days old. The sows are maintained on an even feed regime of about 7 lb daily after farrowing and until three weeks after service, when the feed is reduced to about 5 lb a day. This feed level does not cause problems in drying off and the sows are in fit condition.

Economy in buildings has been achieved by converting old stables into four rooms each with twelve crates in three tiers. The twelve cages in each room cost £219 to accommodate 108 piglets but the total cost of conversion amounts to about £500 for each room. Each cage accommodates nine pigs on mesh floors, below which is a side-sloped solid floor from which the urine flows into a trough piped to a drain. The faeces is not cleaned away until the batch of pigs is moved after three weeks to kennel-type pens with straw bedding. This latter accommodation is temporary until a decision is reached



5½-week-old pigs awaiting removal

on whether further expansion should be with flat decks or kennel rearing in new buildings.

The cages are throughly cleaned by pressure hose after each batch and the rooms fumigated with formalin. Temperature is maintained at 27°C for the first week, then reduced to 24°C for the second week and 21°C in the third week, after which the pigs move to the kennels. It is controlled by thermistor, all the air being drawn through inlets from the control service area over calor gas and electric heater units.

Weaning pigs at this young age is successful due to new formulations in nutrition, better control of the environment and a high standard of management. On this farm a milk-based pellet is first given to the pigs while they are with the sow and continued when they are moved to the cages; a cereal based pellet is introduced about a week after weaning. The piglets eat 6 lb and 8 lb respectively of these foods, which takes them to approximately four weeks old. A home mix ration containing 16 per cent protein is then introduced, allowing a week with a mixture including both feeds during the changeover.

Although the object is to wean the pigs at five days, this varies in practice between five and eight days, influenced by variations in farrowing dates, etc. If possible, litters from gilts are left suckling until the eighth day before being moved to the cages as it has been found that they take a little longer to start eating pellets and scour slightly if moved to cages earlier.

On average the sows are served eight days after weaning, which is working out to be about 13–16 days after farrowing. The few sows that have returned after a second time are sold fat to avoid disorganizing the programme and to save on the unproductive use of food. The number of pigs born per sow is equally as good as the previous three-week weaning; on the writer's visit there were sixty-four pigs being reared by six sows which had farrowed during the previous thirty-six hours.

Conclusion

This system of intensive cage rearing early weaned piglets appears to be working well under a high standard of management, which is a prerequisite for its success. It is a method of rearing which must be considered as only part of the system, and it would appear that greatest benefit could be obtained where breeding and fattening are synchronized in the same unit. It is probably more applicable to the specialist pig unit than to the general farm.

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The next few issues of *Agriculture* will include articles on brown rust of barley, bracken poisoning in pigs, Dutch silverskin onions, modern goose production, climatic resources and economic activity, etc.

Ventilation Problems in Wide Span Buildings

C. Dobson, *Lands Arm, A.D.A.S., Reading*

In recent years there has been a tendency for farmers to erect uninsulated buildings with an effective span of 18 m (60 ft) and over (for ventilation purposes two spans of 9 m with a valley gutter have an effective span of 18 m). Provided the use of these buildings is confined to crop storage there are seldom any ventilation problems, but problems do often arise when this type of building is used to house livestock. Experience has shown that there is a relationship between poor ventilation, wide spans and stocking densities.

To set up experiments to determine the exact relationship of these factors would be extremely difficult and expensive. In this situation use must be made of common sense and evidence from buildings that have been unsuccessful. In practice it is unlikely that poultry would be kept in this type of building but such a building is frequently used for dairy cows, beef cattle and sometimes pigs.

As a general rule, few problems are encountered with dairy cows but problems with beef cattle are quite common. It is worth noting that there are at least two points of difference between the usual dairy and beef housing systems. These are:

(*a*) Beef cattle are much younger than dairy cows.
(*b*) The stocking densities are generally very different.

Whereas cows are not introduced into their final housing until they are 2–3 years old, beef animals are often introduced at 4–8 months. Younger animals are probably more susceptible to respiratory diseases than adults and poor ventilation increases respiratory problems.

Dairy cows weigh around 550 kg (1,200 lb) and stocking rates in fully covered units are about 7m² (70 ft²) per cow (78 kg/m²) (16 lb/ft²). The situation for beef animals has a much wider variation but typical figures are:

Weight in	Weight out	Average	Stocking (m²/head)	Density (kg/m²)
180 kg (400 lb)	420 kg (900 lb)	300 kg (650 lb)	2·5 to 4·0 (25–40 ft²)	75 to 120 (15–25 lb/ft²)

The true stocking density in terms of weight to unit area shows that beef animals are normally more intensively housed than dairy cows. It is suggested that if beef production is not to suffer from disease problems due to poor ventilation then farmers have the following three courses open to them:

1. to delay the introduction of animals into finishing yards as long as possible;
2. to reduce the stocking density to less than 70 kg/m² (15 lb/ft²); or
3. to reduce the effective spans of buildings to not more than 13·2 to 14·4 m (40–45 ft).

Where new buildings are being considered option 3 is economically the most attractive. Similar considerations should also apply to naturally ventilated uninsulated pig housing. In many cases the effective span of wide buildings can be reduced by including large openings to admit fresh air at about quarter-span points. The best example is a 9 m (30 ft) span barn with 7·2 m (23 ft) lean-to spans on each side (23·4 m (76 ft) total span from external wall to external wall). If the lean-tos are attached to the barn about 1 m (3 ft) below barn eaves height then the effective span for ventilation purposes can be reduced. This is brought about by leaving these 1m deep openings uncladded or filled with gapped boarding (or similar material) instead of solid sheets. Should this span be covered with a clear span portal or by a barn and lean-tos without mid-span gaps then in difficult situations the ventilation problems can be incurable by natural methods.

Clearly, when choosing general purpose spans for storage purposes, these problems should be borne in mind. If at some time in the future stock are likely to be housed in such buildings they should be designed to suit the livestock, i.e., medium span and not wide span.

Co-operation at Work

In a new 16 mm. colour film, *Co-operation at Work*, farmers who have worked together explain what it is like for independent farmers to share with one another the running of parts of their enterprises. In the film the farmers explain in their own words why they decided to work together and how their joint enterprises are organized and run.

Five groups are shown in the film. In one, three farmers, each having milking herds on relatively small acreages, make silage jointly. Another group consists of hill farmers and lowland barley growers who have worked together for greater profits; the hill farmer summer's the beef herd and then sends it down to winter on the lowland barley farm, where the buildings and straw suit this arrangement. The film also illustrates co-operative marketing of apples and pears and shows how this benefits growers. A group of pig fatteners, who jointly own a large herd of sows which breeds weaners for them, is featured, and a group of three farmers who have integrated their entire farms into one larger business explain their reasons for so doing.

Not every type of joint farm enterprise could be included in one 24-minute film, but the principles underlying the examples given apply to most forms of agricultural and horticultural co-operation, including machine sharing on arable farms, dairying, lamb marketing and egg marketing co-operatives, etc.

The film was made for the Central Council for Agricultural and Horticultural Co-operation, and will be shown at suitable meetings by the Council's Regional Co-operation Officers, followed by a talk. For this purpose the film will be loaned free of charge, and requests for a showing should be made in writing to Miss Sue Guerrier, Assistant Information Officer, Central Council for Agricultural and Horticultural Co-operation, Hancock House, 87 Vincent Square, London SW1P 2PQ.

Poultry

In a 2,000-bird battery house

This feature section contains articles by:

★ **M. C. Morgan, N.D.P., the Ministry's A.D.A.S. National Turkey Specialist stationed at Wolverhampton.**

★ **F. Carter, B.Sc.(Agric.), N,D.P., the Regional Poultry Husbandry Adviser with A.D.A.S., Bristol.**

Male breeding turkeys in small groups

Turkeys — now and in the future

M. C. Morgan

TURKEY production is certainly a growth industry. In the last ten years the number of poults hatched over the year for the home market has increased from five to over fifteen million and the weight of turkey meat from 20 to 70 thousand tons. This growth has been annual but irregular, ranging from 1 to 28 per cent in any one year. As one would expect, large increases in numbers were reflected in turkey meat prices, which fell quite sharply as a result. Then would come a year or two of consolidation, usually followed by another period of sharp expansion.

Without doubt expansion is continuing and seems already to be following the trend of the last decade. The industry is falling into fewer hands; it is thought that the number of holdings on which turkeys are fattened has fallen from 7,000 to about 4,000 in the last ten years. Over 80 per cent of the national product comes from holdings with more than 5,000 birds; these represent only 7 per cent of the total holdings on which turkeys are raised and about a dozen firms are responsible for some 80 per cent of all turkeys produced.

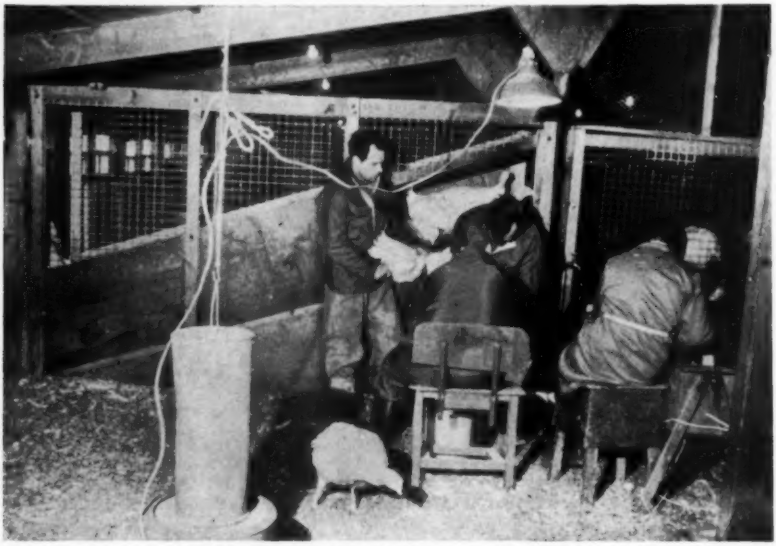
Breeding

So far as breeding is concerned, it is probable that 85 per cent of the day-old poults supplied for fattening in England and Wales come from three

master breeding organizations. To these are attached by franchise agreements half a dozen major breeding units and some 60–70 smaller enterprises which in the past bred their own strain of bird. There are another 125 or so who are independent and breed their own strains; these vary in size, only a few having really large flocks of 5,000 or more, most being small with about 50–60 hens kept primarily to produce their own birds for fattening.

What, then, is the future of the small breeder? It seems that comparatively few newcomers join their ranks, and as the well established breeders give up they are not replaced. It is interesting, however, that several larger orgazations are becoming interested in breeding their own bird or improving the bird they already have. Nevertheless, the likelihood is that the number of breeders will continue to decline.

The British turkey has improved out of all recognition since the last war, and today is as good as any. It is so good from a conformation standpoint that it has become almost unable to reproduce itself, for its breast width makes it difficult for the male bird to mate successfully. As a result, the major breeding organizations, without exception, use artificial insemination as standard practice. But with increased knowledge of diluents or extenders, more efficient use of the male bird is being made.



Turkey inseminators at work

In the not-too-distant future it may be possible to devise a means of storing semen. This will be a tremendous breakthrough and will help greatly to reduce the cost of poult production. It will mean that semen can be held from stags perhaps over a lengthy period, thus reducing the number of stags kept and even the length of time they need to be kept on the farm. Storage of semen in conjunction with the use of an extender must be a major target for our research workers.

Genetic progress with the fowl as far as egg numbers are concerned is likely to be very limited. This may well not be so for the turkey, an animal

about which we still need a wealth of information on its basic requirements in nutrition, environment and management. As knowledge becomes available progress can be expected in improving fecundity. More information about broodiness, incubation environment and some of the more baffling health problems could well increase the poult yield considerably.

Conformation

From the growth and conformation angle it is doubtful whether much more can be done, at least until it is certain that the nutritional needs of improved strains can be satisfied. This year the heaviest turkey competition was won by a stag a little over a year old weighing over 65 lb dead and feathered; its weight alive would obviously have been 70 lb or more. The turkey of today is sold to specifications; 'food per lb of meat produced' and 'weight the bird will reach in weeks' enable the buyer to choose the bird to suit his market.

There are two schools of thought on this. One believes that the rapid growing big bird can be killed early to meet the demand of the small bird market or be carried on to big weights for the catering trade. The other believes that the bird grown specially for the small bird market is better in conformation and finishes at an early age.

For the future, the big integrated producer may well consider only one factor—the cost of producing 1 lb of turkey meat. This single factor will include costs at all stages—a low cost poult, high stocking density in housing, high food conversion efficiency, a fast throughput in the processing plant.

The turkey market

The turkey market has changed fundamentally. From a bird sold principally for the Christmas dinner and banqueting season around that period, it has become a serious and acceptable competitor to red meat as the alternative 'weekend joint'. It is one of the few products which has reduced in price over the years, and in the face of quite substantial increases in costs. This has been made possible by the very high standard of efficiency of our major production units and the degree of sophistication developed both on the farm and in processing plants.

In 1971 the number of birds sold outside the Christmas season was almost the same as that sold at Christmas. Very extensive promotional and advertising campaigns resulted in this revolution. Over the year 1971 the main sales were:

Easter	1,500,000
Whitsun	500,000
Mid-Summer weekends	300,000
Weekends	1,500,000
Catering trade	2,000,000
Christmas	7,000,000

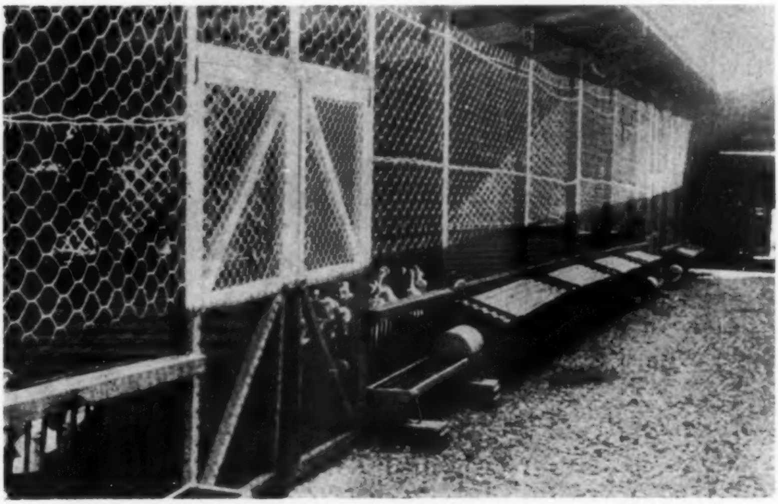
For all purposes except the catering and the Christmas trade, the customer demands a comparatively small bird varying from 5–10 lb. The traditional fresh dry plucked bird is still most popular at 9–12 lb, the popular weight at the supermarket counter is 5–8 lb, while the catering bird is usually 20 lb or more.

Without doubt, the introduction of the frozen oven-ready mini-turkey has been the major reason for the growth of the industry as we know it today for its has brought the turkey within reach of the man in the street. The unit cost of the weekend lunch is what really counts to the customer but another important consideration is that 'left overs' are a very real fact with heavier birds.

In recent years certain outlets have developed a strong customer demand for fresh turkeys killed and processed in much the same way as the frozen oven-ready birds, except that they are dipped in hot water at lower temperatures, thus keeping the epitheleal layer of the skin intact. These birds do not go into brine tanks or blast freezers but are merely chilled and then loosely bagged in polythene. They absorb much less moisture than those frozen and are ready for preparation and cooking without a lengthy thawing out period.

Deep frozen birds will undoubtedly continue to attract more customers because they almost always sell at a few pence less per lb than the fresh processed carcases, at a price competitive with other meats.

Some resistance to both broiler chickens and turkeys undoubtedly exists. The same applies to barley beef or to any meat product killed at an early age.

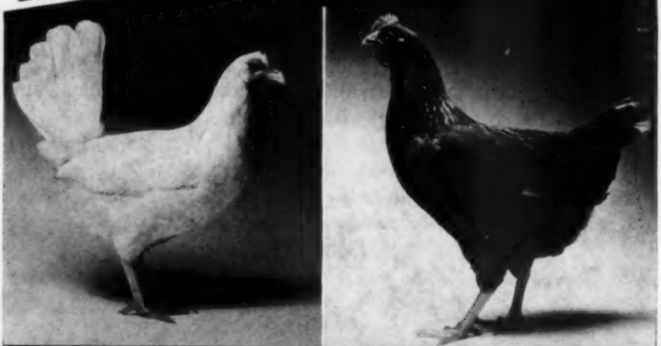


A sophisticated pole barn for turkeys. Note external access to troughs

Over the years the small farm flock has always been expected to disappear and yet it is still with us. In fact the product from the small producers, usually hand plucked and often sold undrawn, has earned very considerable premiums in recent years. These birds are often sold either direct to the consumer, to the butcher who handles turkeys only at Christmas, or to commission markets. When the small producer presents a fresh bird ready for the oven his profit is rarely less than £1 per bird.

Turkeys have usually been reared in simple low cost housing, often using existing buildings and labour not fully engaged during the later months of the farming year.

Great British Birds



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Processing

Today the poultry processing plant is one of the most sophisticated departments in the industry and is extremely demanding in both capital and labour. However, in the next decade there will undoubtedly be much progress in automation. Fully automated processing plants, including automated removal of the offal, will become widespread and fewer people will be working on the processing lines although there will be skilled operators at key points to see that efficiency is maintained. Some jobs, however, may well remain beyond the ingenuity of man and his inventive ability to automate.

Health standards, already high, will become even more rigorous. Veterinary inspection on the production line is likely in the future and if processing becomes even more automated the standards of hygiene and inspection will have to be maintained at a high level.

Prepared dishes

Further processing of poultry products in this country is in its infancy. During the past few years some progress has been made where turkeys are concerned and even greater developments can be expected. Already most appetising and convenient dishes are prepared by several of our major processors. These vary from straightforward jointing of the carcase to sophisticated cooked products; turkey breast fillets and steaks compete with veal and even undercut steak, drumsticks and wings with the coarser meats for casseroles.

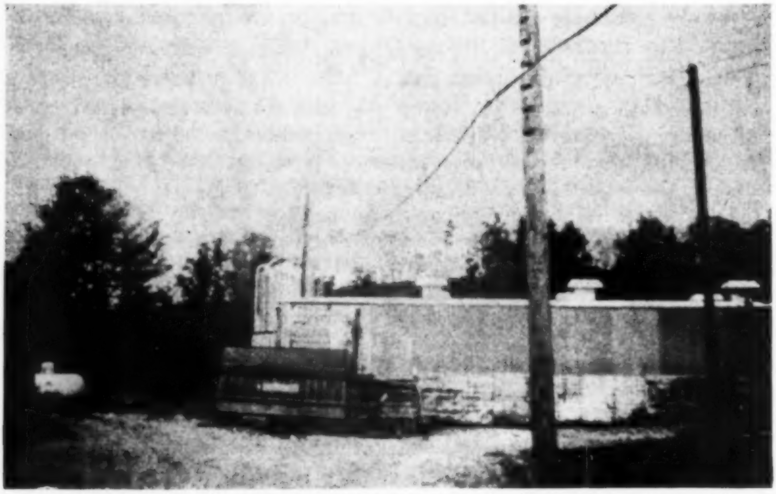
The annual consumption of turkey meat per head in Britain is still only 2·8 lb, whereas in Canada, the United States and Israel it is 3–4 times higher. There is therefore considerable scope for expansion and turkey will doubtless feature increasingly on institutional menus. The use of turkey rolls and prepared individual dishes will allow price and portion control to be maintained, which is so necessary in catering.

Welfare codes

Codes of recommendations for the welfare of livestock, including one for turkeys, have been issued under the Agriculture (Miscellaneous Provisions) Act 1968 to provide authoritative advice on humane management. While it may be felt that some of the recommendations tend at present to place the home turkey industry at a disadvantage with E.E.C. competitors, we consider ourselves to be among the leaders in the field of animal welfare which other countries are likely to follow in the not-too-distant future.

Prospects for future

At a recent conference of the British Turkey Federation, its Chairman, Mr. Bernard Mathews, looked ahead twenty-one years. He forecast that, by then, we would be marketing nearly 50 million whole turkeys every year, together with a sizeable output of further processed products, bringing consumption to about 10 lb per head. This is a challenging prospect for the turkey producer in the years ahead.



Overhead pipeline of pneumatic mash blowing system leading to storage bin outside poultry unit

Feeding
The Modern Layer

F. Carter

WE are constantly adding to our knowledge of, and gaining experience on, how to feed modern laying birds, and while the general statements and information given in my article in *Agriculture*, June 1970 still basically hold good, there are one or two points which can now be looked at more closely.

The medium energy type diet of 1,200 to 1,220 K cals* has certainly continued to prove the most economical ration for light-medium type layers, with the possible exception of a short period in late 1970 and early 1971 when the price of barley and wheat rose alarmingly close to that of maize so that on a unit energy basis maize became the most economical cereal to use. By and large poultry farmers and feed compounders have accepted that the medium energy diet is the most satisfactory.

Minimum protein requirement

In recent years, and particularly during last summer, A.D.A.S. poultry advisers have been concerned at the number of flocks of light birds in particular which have shown a drop in egg production and a lower than average egg size at peak output during a spell of higher than average temperature. Peak output occurs in normal pullets over the first 3–4 months of lay; although

*Calculated according to Bolton, W., M.A.F.F. Bulletin No. 174 Poultry Nutrition. Most other tables will give ME values of 30 or more K cals per lb higher for identical rations.

egg numbers will have declined from the peak production figure, egg size will be gradually increasing so that actual egg weight output remains similar during this period.

In these cases of lower than average performance a scrutiny of the records has nearly always revealed low feed consumption (around 3·5 oz per bird per day), and in a number of cases rations have been analysed, often revealing a total crude protein content of only 14–15 per cent.

Standards of minimum crude protein requirement for layers are now generally accepted and an intake level of 17 grams of crude protein per bird per day is recommended for light birds and 18–18·5 grams for heavy birds.

It is recognized, too, that there appears to be a minimum total crude protein requirement notwithstanding the minimum amino acid levels. This means that at a feed intake of 3·5 oz per day (99 grams), a total crude protein percentage of at least 17·2 per cent is required in the ration; 16 per cent is not enough at this level of intake and the bird would have to eat 3·71 oz (105 grams) per day of a 16·2 per cent protein ration to receive the minimum protein requirement of 17 grams. When the bird is eating 4 oz per day and over, a 15 per cent protein ration will ensure an intake of 17 grams per day. The table illustrates these requirements.

Table Minimum protein levels for layers at different feed intakes

Feed intake		Calculated minimum protein level	
oz/bird/day	g/bird/day	Light hybrids at 17g/day	Heavy hybrids at 18·5g/day
3·4	96	17·7%	—
3·5	99	17·2%	—
3·6	102	16·7%	18·1%
3·7	105	16·2%	17·6%
3·8	108	15·7%	17·1%
3·9	110	15·4%	16·8%
4·0	113	15·0%	16·4%
4·1	116	—	15·9%
4·2	119	—	15·5%
4·3	122	—	15·2%
4·4	125	—	14·8%
4·5	128	—	14·4%

Calculated rations often show protein levels on chemical analysis to be ½–1 per cent below the calculated level, so it may be advisable to allow for this when formulating diets and to give at least ½ per cent tolerance. It would seem that although layers are able to regulate their feed intake to some extent with regard to energy requirements, they are not able to do this for protein.

Now that layers are generally being kept at higher temperatures than hitherto (65°F aim in winter), in an effort to lower feed consumption and avoid stress (for every 1°F rise in temperature a feed saving of ½ per cent should be achieved) it has become more important to ensure the correct level of protein geared to feed intake, particularly during the summer months. A.D.A.S. poultry advisers will be doing their best to spread the word on this subject during the summer of 1972.

Calcium intake

The layer's calcium requirement of about 3·2 grams per day mentioned in my previous article still holds good. Again, rations should be formulated so that the bird receives this amount of calcium according to feed intake.

A recent piece of research work published by Milton Scott* indicates that if one-half to three-quarters of this daily calcium intake is given in the form of oyster shell grit instead of limestone flour, improved eggshell strength will result. The grit remains in the gizzard for a longer period and calcium is released at a steady rate, particularly at night while the shell is being formed. Taylor†, of Southampton University, confirms this conclusion, but he goes further in suggesting that feeding half the calcium as limestone grit or oyster shell results in a lowered overall feed intake without lowering egg production, and he quotes a saving of 8 lb of feed per bird per annum on one small experiment.

Field observation and farm trials by A.D.A.S. poultry advisers strongly supports the work on improved shell strength, but it is too early to say whether actual feed consumption is reduced and more investigational work on this will have to be done on a field scale. Recent work at Harper Adams College also confirms improved shell quality, but does not show any saving in feed consumption.

There are practical difficulties in the way of putting this recommendation into practice. Compounders might agree to add half the calcium in grit form, and the ration would be delivered in the usual manner and blown into a bulk bin; apart from a little more wear and tear on delivery augers no extra trouble should result.

Home mixers, however, do face difficulties with certain continuous flow machines, where all the ingredients are flow monitored and go through the hammer mill together so that the calcium grit would tend to be broken up. Also, farmers using the increasingly popular pneumatic blower type mash delivery from the mixing unit to the poultry house face the probability of extra wear and scratching of the plastic delivery pipes. For these reasons it would seem better to add the grit in the laying house, although with the large laying units of today this would require extra labour, thereby detracting from the value of the exercise. No really satisfactory method of adding grit automatically to the feed hoppers is yet in operation.

Feed restriction

The *ad lib* method of feeding of both growers and layers is being questioned by many research workers, and there is a good deal of experimental and practical evidence to show that feed restriction during rearing is certainly not detrimental and may actually result in improved egg production during the laying period.

Qualitative restriction during rearing has long been practised in order to delay sexual maturity in the laying pullet and consequently obtain a larger egg size at point of lay. Lighting programmes during rearing are of course aimed at achieving a similar result, and feed restriction should be carried out

*Scott, M. L. and Mullenhoff, P. A. (1970) Dietary Oystershell and Eggshell Quality, Department of Poultry Science, Cornell University.

†Taylor T. G. Food Intake, parathyroid hormone and calcium metabolism in the laying hen. Symposium-Harper Adams College 1971.

in conjunction with a suitable lighting programme. Qualitative restriction allows *ad lib* feeding of a low protein or low lysine diet, either from day-old to 18–20 weeks or from 8–10 weeks onwards; the ration is formulated to contain about 13–14 per cent protein.

Quantitative feed restriction has been practised with considerable success for many years in rearing broiler breeding stock to achieve a similar purpose and to prevent over-fatness in large heavy birds at point of lay. The aim of all feed restricting practices in rearing is to produce lean, fit and uniform birds at point of lay. Properly controlled quantitative restriction, when rearing laying pullets, can achieve a feed saving of 10–15 per cent and will also have a positive effect on subsequent performance; the birds are actually physically restricted on feed intake from 10–12 weeks to 20 weeks of age. In feed saving alone the benefit would amount to around 3p per bird, and experimental evidence to date indicates an improvement in hen housed average production of about two eggs.

Field observation has shown that birds sometimes become over-fat during the second half of the *laying year* and poorer than average egg production results. This is often due to over-consumption of diets fairly high in energy content. A change to a lower energy diet may help, but once excess fat is laid down in the bird this method will take time to show any effect. Therefore, actual feed restriction may achieve quicker results and if applied soon enough may avoid fat deposition in the first place. Feed intake should therefore be calculated on actual nutriment requirement and a restriction of up to 10 per cent may be applied accordingly. Feed saving alone could amount to about 10p per bird.

There are also practical difficulties in applying this recommendation to layers in battery cages. If the diet is restricted, certain birds high in the peck order may eat more than their own share of the food, so that other birds are more forcibly restricted than the operator intends; therefore it is essential to maintain strict observation and to keep reliable records.

On the farm mixing and mash moving

As economic conditions for the poultry keeper become harsher, so more and more farmers are turning to processing their own rations on the farm. Of the three farm systems reviewed in my article of June 1970—the batch system, the continuous flow system and the mobile mill mix—the continuous flow system is easily the most popular. Over 90 per cent of new plants being installed on farms are of this type. Such units are fully automated and therefore extremely economical on labour. The main disadvantage is that they are better suited to farm mixing using a proprietary purchased concentrate than using all straights for a fully home-produced ration.

At the time of writing (March 1972) it is possible to save approximately £1 per ton on the finished mash by mixing with all straights, using protein feeds such as fishmeal, soya bean meal, meat and bone meal and a proprietary vitamin mineral mixture. Some farmers have solved this problem by pre-mixing the concentrate in an old or secondhand vertical type mixer, but this does involve an extra chore.

The method of moving mash by pneumatic blowing through a small bore pipe system is also rapidly gaining in popularity on many farms. It uses air pressure at 4.7 lb per sq. in. to blow mash feed through a 1½ in. diameter plastic pipeline at a range of up to 450 ft. A delivery rate of 10–12 cwt per

hour can be achieved, which avoids the need for special mash moving trailers and the use of labour and tractor to move the mash.

The system is ideal where the poultry farm is fairly compact and the houses are within 450 ft of the mixing shed. Used in conjunction with a continuous flow production method, mash holding bins are filled in rotation simply by coupling up the pipelines from the machine to the bins in the desired sequence. Gradients and right-angled bends in the pipeline make little difference to the delivery rate or to the cost of installation, whereas an auger system involving different levels and bends would prove very costly. The cost of an installation to deliver mash to three or four houses is £600–£750, depending on the length of pipeline required, while the cost of the actual machine is about £500.

The National Institute of Agricultural Engineering at Silsoe, Bedfordshire, has been testing a similar system for delivering hard pellets through a 2 in. bore plastic pipe using a pressure of up to 10 lb per sq. in. A delivery rate of one ton per hour has been achieved in a system containing a large number of right-angled bends. Observations are currently being carried out into the wear in the plastic pipes.

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Hope for Rare Livestock Breeds

Breeds of livestock in danger of dying out may be given a new lease of life when the Rare Breeds Survival Trust gets under way. The Trust, which is being set up for the preservation of domestic breeds, especially those in danger of extinction, is now in the final stages of formation as a charitable body.

The Earl of Cranbrook has agreed to be its President and a provisional committee has been formed under the chairmanship of Mr. J. Henson, owner of Cotswold Farm Park, Guiting Power, Cheltenham. The Trust will undertake a wide range of operations aimed at ensuring the preservation of breeds of British farm animals which have played an important part in the history of livestock breeding.

Apart from the sentimental reason of conserving animals for posterity, there are important scientific reasons for keeping small numbers of rare breeds in existence. The most important is that they may possess genetic characteristics which will be of use to future livestock breeders.

Membership of the Trust will be sought from both individuals and organizations. Further information may be obtained from Mr. J. Henson, Bemborough Farm, Guiting Power, Cheltenham, Glos.

From management studies at Bridget's E.H.F. have evolved likely methods of

Reducing the Calf Rearing Chore

K. P. Swannack

OVER the last five years or so Bridget's Experimental Husbandry Farm has been evolving a philosophy for the management of large dairy herds. This has involved a close look at many aspects of the management of both men and animals and has given scope for a continuing investigation into methods of reducing the effort expended on the rearing of replacement heifers.

In England and Wales over 800,000 dairy heifers are reared annually at a cost of about £60,000,000; this is a field of work in which a study of methods and the evolution of a system could pay handsome dividends. Moreover, it is a field in which the results could be shown to have a wide application to farms of all sizes.

Calf rearing on the minimum labour dairy farm of today is an extra seasonal chore, an inflexible twice daily routine imposing an extra work load, often at the least acceptable times, after the completion of milking at both ends of the day. Moreover, the job of food mixing and washing up after feeding demands little of the experienced stockman's skill but adds to the length of his working day.

The rearing of calves intended for dairy herd replacements differs from the rearing of calves for beef in that they are usually born on the farm and therefore have more resistance to indigenous disease organisms. Unlike beef calves, which are often purchased at up to three weeks of age, dairy calves must be reared from birth. It is not necessary for them to make such high liveweight gains as beef calves in the first six months of their lives, although to a degree this will depend on the age at which it is intended to calve them.

Aims for a rearing system

The primary aim of a successful calf rearing system must be the production of a bright healthy calf. But this must be achieved at an economic cost, so that attention has been focused on attempts to minimize labour by reducing the chores associated with the liquid feeding period and the length of this period to minimize health problems and to minimize food costs.

So long as the early nutrition of the calf before weaning does not affect production potential during its later life the main consideration in a system of calf rearing may well be one of simple economics and the raising of a healthy calf.

Cutting the chores

The aim at Bridget's with a closed herd having no brought-in disease problems, is to produce well grown, cheaply reared Friesian heifer replace-

ments for the dairy herd. To do this the calf requires a good start. Calves are born with little resistance to disease and relatively low liver stores of vitamin A. Both vitamin A and the antibodies are required by the calf to combat disease organisms present in the environment into which it is born. These are richly supplied in the colostrum from its dam. Since the calf's ability to absorb antibodies from colostrum declines rapidly after the first few hours of life, leaving the calf on its dam for twelve hours is probably the easiest way to ensure that it obtains the advantage of an early full feed of colostrum. The importance of this cannot be overstressed; it can have great effect on subsequent health and performance.

Most of the cows in the Bridget's herd calve between August and Christmas, up to twenty in some weeks, in ones and twos, or none in others. This pattern, common in dairy herds, militates against the use of mechanized feeding systems. These may be well adapted for the batch rearing of steer calves, but bucket feeding is our system of choice. To eliminate some of the associated chores—food mixing, feeding and washing up—and to enable feeding to be done at a time to suit the farm routine, the once-a-day cold liquid feed system has been adopted for rearing commercial replacement heifers. This also has the advantage of reducing to a minimum the need for communication between staff working on a different shift and thus helps to eliminate mistakes and differences in feeding techniques.

The change from traditional twice-a-day feeding of warm fluids to once-a-day feeding of cold fluids has enabled us at Bridget's to simplify calf rearing and to eliminate half of the work involved. Other benefits have accrued from the pursuit of simplification. The temperature of the liquid diet when fed cold direct from the tap varies only a few degrees during any liquid feeding phase and thus eliminates larger fluctuations found in day-to-day warm feeding. Abrupt changes of diet at commencement and weaning are now the rule and they appear to have no ill effects on the calf, while making for an easier calf house routine.

It has been said that cold feeding does not seem to have been really successful away from the Experimental Centres. It is true that the more northerly centres have had less success than those in the south and that where the temperature of the liquid feed fell below 40°F (4·4°C) calves have either refused, or been slow, to drink their milk substitute. It may well be that cold feeding systems are only useful in the milder areas or in the warmer months.

In earlier trials at Bridget's, once-a-day calf feeding was done in the afternoons. The time of feeding, however, is not important, except that it should remain consistent once begun. Our men now prefer to feed the calves in the early mornings. Once-daily feeding does not, of course, mean a once-daily look at the calves. Time spent in observing young animals and spotting trouble before it has developed is time well spent.

Other factors in success

Clean housing is critical to the success of the rearing routine. We start each year with a calf house which has stood empty for at least two months after it has been properly cleaned with a pressure hose, a scrubbing brush and washing soda, followed by fumigation with formaldehyde. This cleaning routine goes a long way towards preventing the build up of disease organisms in the calf house. However, even a good annual cleaning routine cannot

provide a sterile environment for calf growth and no known cleaning routine alone provides the protection from disease necessary for the production of healthy, thriving calves. Real immunity to disease has to be built up and this can be done by generous colostrum feeding at birth.

The provision of draught-free accommodation plus a dry bed are the other indispensible requirements for easy calf rearing. Fresh air, even at low temperatures, will not harm calves provided it is draught-free at calf level. In order to keep humidity in the calf house as low as possible, we use the minimum of water for floor and passage cleaning.

Adopting a once-a-day liquid feeding routine can give satisfactory results only if time is spent during the first few days teaching calves to drink properly. With the Friesian this is usually easy to achieve. At Bridget's we feed warm fresh colostrum twice daily for the first four days of life to get calves feeding without help, and then we change over to a cold once-a-day regime on the fifth day of life. If calves are not drinking properly at the changeover trouble will be experienced.

Reducing days to weaning

The fluid fed calf is apparently more at risk from digestive upset than the weaned animal. Giving less liquid feed at a single daily feed has reduced digestive disturbance as well as leading to earlier acceptance of solid food. Thus earlier rumen development has occurred, resulting in fewer days to weaning. A policy based on restricted feeding of milk replacer would appear to benefit calf health and lead to earlier weaning thus reducing the labour requirement for calf rearing.

Trials showed that days to weaning could be cut by a week (from 30 days to 23 days) if weaning was done at a daily solid food intake of 1 lb instead of 2 lb; and that 1 lb of a high fat milk replacer powder in 4 pints of cold water at tap temperature fed once-a-day was a suitable complementary level of daily liquid feed intake. Because in this system the amount of water given with the milk replacer is reduced to 4 pints a day. The provision of water troughs and bowls is particularly important because calves on this regime drink large quantities of free water. The occasional calf is not fit to wean at a month old and it may be better to relate age at weaning to solid food intake and suggest that Friesian heifer calves should be weaned at a solid food intake of 1½ lb per day or twenty-eight days of age, whichever is the later. At Bridget's, to encourage really early solid food intake we hand feed early weaner concentrate to all calves from about the first week of life. This is time well spent and gives a chance for the stockman to keep a close watch on his calves.

Looking for cost reductions

The most expensive period in baby calf rearing is that spent on liquid feeds. Milk replacers are still, in spite of recent sharp price rises, cheaper to feed than whole milk. However, the price advantage between them is narrowing and with the spur of rising prices, calf feeds containing no milk solids are already being marketed and further technological advances in their manufacture cannot be far away.

It has been a generally accepted practice to start calves on whole milk or milk replacer on the fifth day of life. Rigid adherence to this programme has, in many cases, meant throwing away surplus colostrum, a free feed, in favour

of an expensive replacement powder.

Three years ago we began preliminary studies on the feeding of colostrum to calves for periods exceeding the conventional first few days of life. The work showed that the Friesian cow gives 10-14 gallons of colostrum in the four days after calving which must be excluded from sale to the Milk Marketing Board. This quantity, fed at 4 pints per day, is almost sufficient to provide for the whole liquid feeding phase of the calf's life, and certainly if bull calves are not reared on the farm sufficient stocks of colostrum can be collected to rear all heifer replacements.

Frozen colostrum feeding

In an early series of observations fresh colostrum was stored by freezing. Frozen colostrum, thawed before feeding, gave results equally as good as milk replacer when fed right through to weaning. Similar results were obtained when the colostrum was fed for the first fourteen days of life, or for alternate periods of seven days with milk replacer to weaning. Four pints per day of colostrum gave almost the same daily liveweight gains to weaning as 1 lb of a good milk replacer powder. The observations appeared to indicate that where adequate colostrum was not available to satisfy the whole of the liquid feeding phase of the calf's life it could be successfully substituted as necessary with a milk replacer.

The freezing of large quantities of colostrum, although common practice on Experimental Stations, is impractical and expensive on the farm. Preservation of colostrum by chemical or biochemical additions involves weighing and mixing and it seemed to us that the early promise of extended colostrum feeding must prove abortive if no cheap and easy way to store surpluses could be found. It was by chance that we heard of a local farmer who was apparently feeding naturally soured stale colostrum to calves without ill effects. Natural souring appeared to offer a way of storing the surplus simply and at low cost.

Storing and feeding stale colostrum

More evidence and experience was obviously required. At Bridget's, therefore, to test the observations of the local farmer, some calves were fed on colostrum, collected and stored in 10-gallon churns stood in the calf house feed preparation room with muslin fly covers in place of lids. Souring of the stored fresh colostrum took place rapidly and the consistency remained about the same as thickened condensed milk, somewhat resembling yoghurt, the low pH of the material apparently acting as a preserving agent. Calves offered stale colostrum after anything up to twenty-eight days in the churns drank it without trouble.

Further trials have confirmed that

(*a*) colostrum need not be fed fresh to calves after the first four days of life,

(*b*) stale colostrum, when available, could be fed satisfactorily to weaning or could be alternated with milk replacer,

(*c*) calves on all treatments in the trial showed equally good liveweight gain to three months of age and there were no feed refusals and no health problems.

A quick stir of the colostrum before ladling into buckets reduced the chore of feed mixing and when colostrum was fed right through to weaning a

saving of the order of £2 to £2·50 per calf could be made, depending on the current price of milk replacer powders.

Repeated trials conducted over the last two years have confirmed the earlier findings, and shown that the natural souring of colostrum delayed during very cold weather preserves it as a stable feed for calves, at least for the normal winter feeding period. It seems clear that sour colostrum can be regarded as a wholesome, readily accepted food for dairy heifer calves. It is not unpleasant to handle and saves the chore of milk replacer re-constitution, while the elimination of milk replacer powder saves approximately 75 per cent of the feed costs to weaning.

Over the years we have adopted in our calf rearing routine at Bridget's the various techniques which have been shown in trials to be worthwhile. Today our commercial rearing practice is extended colostrum feeding once-a-day cold to calves who are then early weaned at a solid intake of 1½ lb per day or about twenty-eight days of life. We have reduced the chores by half and reduced the number of days on which they must be performed, while at the same time reducing substantially the early costs of rearing dairy herd replacements.

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Ministry Publications

Since the list published in the May 1972 issue of *Agriculture* (p. 226) the following publications have been issued.

MAJOR PUBLICATIONS

BULLETIN

No. 201. Hot Water Treatment of Plant Material (Revised) 42p (by post 45½p) (SBN 11 240501 0)

OUT OF SERIES

Farm Incomes in England and Wales (New) £1·50 (by post £1·61) (SBN 11 241027 8)

FREE ISSUES

ADVISORY LEAFLETS

No. 34. Plum Aphids (Revised)
No. 178. Stem Eelworm on Arable Crops (Revised)
No. 247. Quality in Seeds (Revised)
No. 273. Powdery Mildew of Gooseberry and Black Currant (Revised)
No. 280. Weed Control—Ragwort (Revised)
No. 291. Black Scurf and Stem Canker of the Potato (Revised)
No. 543. Black Currants (Revised)

SHORT TERM LEAFLETS

No. 14. Chemical Weed Control in Bush and Cane Fruits (Revised)
No. 137. Vegetable Growing on the Bed System (New)

Priced publications unless otherwise stated are obtainable from Government Bookshops (Addresses on p. 280) or through any bookseller. Single copies of free items are obtainable from the Ministry of Agriculture, Fisheries and Food (Publications), Tolcarne Drive, Pinner, Middlesex HA5 2DT.

Silt/Sand Management

F. G. Smith

WHEN, in 1950, Stockbridge House Farm, Cawood, was taken over for its present use as an Experimental Horticulture Station, it was recognized that the soil would represent something of a challenge if it was to be made capable of producing high yields of vegetable crops. The farm, in fact, offered many of the requirements specified for the development of an experimental horticulture station, and if the soil type was not one of them it was argued philosophically that good experimental results obtained from an unfavourable soil would be more convincing than results from an ideal.

Station soil types

The Soil Survey has since named seven different soil types on the Station, all derived from Fluvio-glacial sand deposits overlying lacustrine clay at variable depths up to 5 ft. Surface texture varies according to the proportion of silt and clay mixed with the sand.

The topography of the farm is flat at 25 ft above sea level. There is a continuous water phase overlying the impervious lacustrine clay. Drainage is by tile drains into open dykes cut to the depth of the clay bed, and is slow by virtue of lack of fall. The open dykes lead eventually to the River Ouse about one mile from the farm. The Ouse is tidal at Cawood and, in times of flood, water backs up the open dykes to a level within 1 ft of the soil surface; actual surface flooding has not occurred since 1947. In times of flood and after prolonged heavy rain the soil to a large extent loses its load-bearing capacity and deep ruts occur if tractors or vehicles move over it, a condition frequently seen on headlands.

In spite of the impervious lacustrine clay at 3–5 ft depths, the surface soils all have a low clay content—not more than 10 per cent. They are also characterized by a tendency for organic matter in them to oxidize readily, so that if not frequently replenished it tends to stabilize at a level of about 2 per cent. The low clay content combined with low organic matter give a soil from which plant nutrients and lime are easily leached and structure all too readily lost, resulting in heavy capping and local ponding.

The soil, when the farm was originally taken over, was extremely acid, and over a large proportion dressings of lime in the form of magnesian limestone were necessary to a total of 6 tons per acre before pH figures of 6·5 were achieved. Heavy dressings were not applied all at once; it was necessary to build up organic matter at the same time to improve the retention of both lime and other major plant nutrients, all of which were below the best levels for cereals, let alone vegetables.

To build up the organic matter in the soil, farmyard manure was produced by yarding bullocks, and this was supplemented by purchases of spent mushroom compost ('spent', incidentally, only from the point of view of

mushrooms). Leys were established and used to produce silage and hay. In a normal farming situation it would no doubt have been expedient to have grazed the leys, but one of the special needs of an experimental station is that the fertility of the soil should be kept as uniform as possible. Uneven dunging of cattle grazing the leys would have created problems when they were ploughed out for experimental cropping.

Early treatments

Bearing in mind the very low initial organic matter status of the soil, the general approach in the early years of the Station was to apply heavy dressings of FYM or spent mushroom compost to those vegetable crops judged most responsive. Applications were made at 40 tons to the acre. On glasshouse sites, applications of 100 tons per acre were found to be necessary before satisfactory lettuce crops could be produced. We are, however, concerned here only with the management of the soil for outdoor crops; but even in the open, on experimental sites where an all-vegetable rotation was imposed it was not until three dressings of FYM at the 40 tons per acre rate had been applied in successive years that the soil cap in spring was sufficiently weakened to allow small seeded crops such as onions and carrots to break through and germinate satisfactorily. At the end of such treatments, soil samples indicated that the organic matter content of the soil had been raised from about $1\frac{1}{2}$ to 4 per cent. It was clearly not feasible to apply such heavy dressings of FYM except by a piecemeal approach. Apart from cost, dressings in excess of 40 tons per acre are difficult to incorporate and the more finely divided spent mushroom compost is to be preferred where seedbeds are to be produced.

Use of leys

The problem was to maintain organic matter at a high level once it had been built up by applications of FYM; this has been achieved by the use of leys, and to some extent by the inclusion of cereal crops in the rotation. Because of problems of scale, it has always been difficult to conduct experiments on the Station to measure the value of leys, and present assessments are based on empirical observations over the last twenty-two years rather than a truly critical approach. Experience has shown that where it has not been possible to replenish organic matter in the soil with repeated applications of FYM, the inclusion of leys in the rotation has at least prevented the deterioration of the soil to the state in which we first knew it, and has made possible the continued cropping of the soil with vegetables of all kinds.

In the early years of the Station we tended to establish leys by undersowing corn crops, but as the fertility of the soil improved the cereal crops presented undue competition and undersowing was dropped in favour of direct sowing. Initially, we used various grass mixtures for our leys, some of which included wild white clover. Since, however, the leys were required for silage and consequently received heavy dressings of nitrogen, the clover very soon died out. Also, there seemed no advantage in including more than one species of grass since the timing of the cutting of the ley was conditioned by the earliest species in the mixture to develop flower heads; this is not necessarily when the ley established from mixed species is in its most productive condition for a silage cut.

Up to a period of five or six years it would appear that the beneficial effects of leys on our soils are proportional to their duration. Although a special

case can be made for the very short-term ley, it is clear that the soil derives maximum benefit from a cocksfoot ley (leafy commercial strain) left down for at least five years. Such leys are most persistent and withstand cutting for silage three or four times each year with heavy dressings of nitrogen between each cut. Perennial ryegrass (S23), although earlier, seldom remains productive under such treatment for more than three years.

Short-term leys of an annual ryegrass (usually Westernwolths) are used to protect the soil structure during the winter months. They are established in late summer in vegetable rotations following peas or summer maturing brassicas, and where it is convenient to introduce winter wheat into the rotation. Their function is chiefly to protect surface structure of the soil from being broken down by hammering of heavy rains during the winter months, a condition which leads to ponding. Good and rapid ground cover is required, so heavy seed rates are used—56 lb per acre—of an annual ryegrass. Westernwolths has a special value in making quick growth in the autumn if sowing is delayed. These short-term leys are also of value in taking up autumn nitrogen which can be released as the green material decays for the crop in the following year if ploughing under in the spring is not too long delayed—an operation which should, in any case, be undertaken before the beginning of April if soil water reserves for the following crop are not to be jeopardized.

Effect of a previous year's headlands on the growth of wheat in the following year

Cultivations

The basically weak structure of the soil at Stockbridge House has already been emphasized. This, apart from such conditioning as can be achieved by leys and by the addition of FYM, calls for a careful timing of cultivations. Under wet conditions there is little doubt that compression of the surface is transferred deeply through the profile. Even following the most careful timing of spring operations, depressions of growth may be observed in seed crops where tractor wheels have passed during the preparation of the seed-

bed. Often during the harvesting of vegetables it is difficult to give due consideration to the state of the soil which has to be crossed. Headlands through autumn and winter brassica crops are frequently to be picked out in the cereal crops grown in the following year. A bed system of cropping has been seen as the most likely solution to this problem but with the present range of available machinery, bed systems present their separate problems.

One characteristic of the Stockbridge House soils which has a pronounced influence on methods of cultivation is their ability to 'smear'. This smear is impervious to the downward movement of water through the soil. It occurs where the plough sole passes over the soil at the bottom of the furrow or where the blade of the rotary cultivator impinges on the soil at the bottom of its traverse. The presence of these smears, which are of no more than wafer-thickness, seriously impedes drainage and can also interfere with root penetration in some crops. They can be overcome by running a subsoil tine along the bottom of the plough furrow and by varying the depth of ploughing once a good depth of top soil has been created. The combination of the chisel plough with the rotary cultivator has been found useful in preventing smears when the rotary cultivator has to be used to force a tilth. The rotary cultivator is, in fact, able to produce a seedbed capable of high plant establishment.

We have over the years doubled the depth of the cultivated soil by deeper ploughing and the addition of organic matter. But unless the effects of smears are kept in mind, it is clear that the problems which occurred originally at 5 in. depths due to the build-up of surface water can now occur at 10 in. with almost equal devastation.

Management

It is appreciated that the value of many of the management approaches made to the soils at Stockbridge House may still be regarded as matters of opinion. For example, while we have achieved straight line yield responses with some vegetables to increasing applications of FYM, with other crops and other soils no direct benefit has been reported whatsoever. Such are the variable factors from one year to the next and from one soil to another that no hard and fast rules can be laid down. Soil management should, perhaps, be seen as the need to take precautions against the worst vagaries of the interaction of soil and climate and is at best a series of compromises. But it is clear that we cannot know too many facts about the way in which our own soils respond to factors both inside and outside our control, and we should regard at least limited experimentation as a management tool which is within everyone's reach.

With a title containing the word 'management', I am sure that I am vulnerable to criticism in that I have not attempted to analyse the costs of the management applied in relation to the effects produced. Let it suffice that a field that once produced no more than 4 tons of potatoes per acre was made, last year, to produce nearly 36 tons; and I would estimate that the value of the land has increased proportionately. Neither of these circumstances could have been foreseen as a guide to management twenty-two years ago. Perhaps when we have listened to all that the economists have to say, we must still proceed by faith and value the land as our heritage, not simply a source of profit but a capital asset to be developed.

F. G. Smith, N.D.H., is Director of Stockbridge House E.H.S., Cawood, Yorkshire.

Towy Valley from Paxton's Folly

Farming Cameo: Series 5

9. Carmarthenshire

E. J. Evans

CARMARTHENSHIRE, or Sir Gâr, is the central county of west Wales. Visitors to the popular west coast are no doubt familiar with the lush green countryside as they motor across the county on the A40 between Llandovery and Whitland, a distance of some fifty miles. The road runs through the heart of the county—the fertile Towy Valley. Narrow at the new Llyn Brianne Dam, the valley widens as it runs westward and beyond Carmarthen extends into the valley of the Taf and the coastland lowlands. On both sides of the Towy Valley, hilly country runs in the form of an extended horseshoe, the circular head of which culminates in high moorland on the county's north east boundary at a height of some 2,000 ft.

Carmarthen is the county town, with a population of some 13,000 and links with the past dating back to a Roman settlement (Moridunum). It is well known for its thriving livestock mart, which has a bigger throughput of dairy cows than any mart in the country.

Llanelli is the largest town and the centre of the industrial area. Its prosperity was built on anthracite coal and steel; there are fewer mines in the area now, but these are very large and highly mechanized, such as Cynheidre Colliery. The huge Trostre cold steel strip mill has replaced old steel-making works. Llanelli is, of course, the 'mecca' of rugby fans in west Wales and home of the

'Scarlets' team. The whole county enjoys rugby and is very proud of the fact that no less than six local players were chosen to tour New Zealand with the British Lions in 1971.

The climate is generally mild, but is marked by high rainfall. Apart from a small coastal area annual rainfall ranges from 55 inches on the lowland to 80 inches on the upland. No wonder, then, that the countryside is clothed in lush green pastures!

Farming pattern

The farming pattern of grassland and livestock is largely influenced by soil types, climate, topography and size of farms. Soils tend to be heavy, of variable quality and often with impeded drainage. The area north of the Towy is mainly on Ordovician and Silurian shales, with good soil on the lower land but becoming progressively thinner at the higher altitudes. South of the Towy the shales give way to a belt of Old Red Sandstone. This area, together with the alluvial river valleys of the Towy, Taf, Teifi and Loughhor, is the most productive land in the county. Farther south, adjoining Glamorgan, lie the Coal Measures, where the soil is hungry and sometimes difficult to drain.

Another striking feature is the large number of scattered small farms. Half the farms are between 30 acres and 100 acres in size, with only a fifth over 100 acres. Generally speaking they are intensively stocked, well maintained and farmed productively. Farm amalgamations have taken place but there has been little impact on the general pattern so far.

Dairying

Dairying is by far the most important livestock enterprise. It has been established in the county for many years and was widely practised in the 1920s. It was greatly encouraged by the establishment of the Milk Marketing Board in 1933 and has since gone from strength to strength. An ability to grow good grass, the small size of farms, a good rail network and later good road transport were no doubt key factors in the development of dairying. More important were the farmers and families themselves who have been blessed with the right temperament and skill for looking after cows. There are many fine herds of pedigree and commercial British Friesians. Some are well known nationally and have made a big impact on the genetic improvement of the breed. Whereas the majority of the herds are still milked in single range cowsheds and fed on hay and purchased concentrates during the winter, there has been a marked trend in recent years to cubicle housing parlour milking and self-fed silage. Invariably a change to the new system has led to a steep rise in cow numbers and stocking rates linked to paddock grazing, with very satisfactory results.

The usual pattern of milk production is 'all-year-round' calving, with 60 per cent of the milk produced during the six summer months and 40 per cent in the winter. As yet, few farms specialize in spring calving and summer milk but this could well change in future with entry into the E.E.C.

Sixty-five million gallons of milk are sold annually and the bulk of this goes for manufacture. There are six factories—five owned by Unigate and one by C.W.S.—for the manufacture of cheese, butter, dried milk powder, condensed milk, etc. Whitland, the largest in the county has a daily capacity of 120,000 gallons.

Other livestock

Sheep flocks are kept on many dairy farms, but as dairy herds expand the sheep tend to disappear. Sheep numbers are more concentrated on the uplands and hills of the eastern part of the county, where there are very good flocks of Welsh Mountain and Speckle Faced sheep. It is these areas also that single suckled herds of Hereford, Hereford cross and Welsh Black beef cattle are found, but compared with dairying the numbers are small. A few pigs are kept—mainly for the weaner trade. Poultry on the general farm have almost disappeared but there are a few progressive poultry specialists and one very large broiler unit.

Brucellosis eradication

When the first Brucellosis (Accredited Herds) Scheme was introduced in 1967, great interest was aroused and many farmers applied for entry into the Scheme. They had practised 'closed' herds for many years with a very high standard of stockmanship so that the percentage of reactors was low and generally herds became accredited without great difficulty. Since part of the county was designated an Eradication Area in 1971 further good progress has been made. This is evident in the increasing number of accredited cows and heifers offered for sale at Carmarthen Mart each Wednesday where they are sold at a high premium. It is interesting to reflect that the county was the first 'clean' area under the Attested Herds Scheme in 1953 and acted as a reservoir for supplying dairy replacements to less fortunate parts of the country. It is again to the credit of our farmers that they are fast achieving a similar reputation with brucellosis-free stock.

New Veterinary Centre at Winchester

A new Veterinary Centre has been opened at Itchen Abbas, near Winchester, Hampshire. The Centre houses both the Animal Health and Veterinary Investigation sections of the former State Veterinary service, now amalgamated as the Veterinary Arm of the Ministry's Agricultural Development and Advisory Service.

The Centre is the first of its kind in the country. It will provide office and laboratory accommodation for staff dealing with scheduled diseases such as foot-and-mouth and bovine tuberculosis; schemes such as those concerned with brucellosis; consumer protection work; and development and promotion work in conjunction with other sections of A.D.A.S. It will also provide a diagnostic and consultative service for veterinary surgeons in private practice in Hampshire and the Isle of Wight, and establish an additional link with the Central Veterinary Laboratory at Weybridge on all aspects of the health of farm livestock.

The Centre, which was built under the supervision of the Department of the Environment, will enable the Ministry's veterinary staff to provide improved services to the farming industry in the area.

in brief

- **Criteria for beef production**
- **Mapping the birds**
- **A matter of habit**

Criteria for beef production

WHY do farmers keep cattle? This is the question posed and examined in a report* issued by the Agricultural Economics Unit of Cambridge; and equally pertinent is the question: Do the cattle keep the farmer? The traditional importance of yard fattening cattle on arable farms to make muck as well as money is less compelling today than our forbears would have claimed for it. To justify cattle on the grounds of using pasture or merely to take up the loose ends of available byproducts or of labour not otherwise engaged, does suggest something in the nature of the tail wagging the dog. The Cambridge report is uncompromisingly dedicated to the proposition that cattle should be expected to show a profit *in their own right* and, with care, that it should be possible to select a system which will produce a profit on most types of farms; and it presents a set of criteria designed to differentiate and evaluate the choice open to the farmer.

Because of its flexibility, beef production can offer a great variety of systems, particularly if store production is included as well as fattening, depending on the size of cattle kept, the season when bought in, the season when sold and the intensity of feeding. Moreover, the systems can readily be switched from stores to fat cattle or from grazing to grain feeding.

A total of thirty-two systems, thirteen of producing fat cattle and nineteen of store production, are presented and their relative advantages and disadvantages assessed with a view to tailoring the system to the individual farm. The merits of each have obviously to be measured by the return obtained for the resources used and, since the most important resource is usually capital, the 'indicator' here is the 'discounted cash flow' over ten years from an investment of £5,000 (i.e., the surplus left after the cattle enterprise has paid all costs, including 10 per cent interest on the capital invested in cattle, machinery, buildings, etc.) Other criteria, such as return per acre, per head, per hour of labour or per unit of housing, are also applied, having regard to the fact that these may be limiting factors on a farmer's freedom of action.

The second and complementary part of this report is concerned with ways of improving the profitability of any given system. Here there is real scope for managerial skill, with a special emphasis on that most important aspect—feeding and the conversion ratio.

Mapping the birds

THE needs of modern farming have changed the countryside not only superficially but in depth. Larger fields, fewer hedgerows, extended forestry with its high proportion of conifer planting, the drainage and reclamation of wetlands and the emphasis in certain areas in recent years on intensive cereal growing, to say nothing of changes due to mechanization and chemical culture, have produced environmental disturbances which could have been foreseen but seldon were. Add to these the hundreds of thousands of acres which have passed into urban development and the results of population pressures and we have a picture of encroachment on rural

Beef Production, by J. S. Kurta (ed. F. G. Sturrock). Obtainable from the Agricultural Economics Unit University of Cambridge, 19 Silver Street, Cambridge CB3 9KP, price 40p

areas undreamt of a quarter of a century ago. This is not to say, however, that all is loss and lamentation, for turning to the distribution and present status of wildlife as just one aspect of the nature scene, evidence is not lacking of adaptation to man's restless world.

Changes in the distribution of bird species and their populations are obvious examples of an environmental effect pointing to a cause, and therefore the British Trust for Ornithology's Atlas Project to map breeding birds throughout the British Isles commends itself as a valuable scientific undertaking important alike to biologists, conservationists and farmers. This is a five-year study involving patient observation and meticulous recording. Over 8,000 observers, from the casual bird-watcher to the scientific amateur and professional, have contributed records during the past four years.

In the closing phase of this project it is hoped that some of the more elusive (and probably under-recorded) species will be plotted, and it is here that farmers and landowners with special and detailed knowledge of their areas may be able to give the Trust valuable information. The list of the wanted 'sightings' includes the Barn Owl and long-eared Owl, Quail, Water Rail, Spotted Crake, Lesser Spotted Woodpecker, Red-backed Shrike, Hawfinch, Scaup, Common Scoter and Merlin; and currently being found more widely in southern England, the Firecrest, Siskin and Serin. Even records of just one bird seen or heard in the breeding season in suitable breeding habitat anywhere in Britain or Ireland are valuable in respect of these species. Such information, sent to the British Trust for Ornithology, Beech Grove, Tring, Herts, giving the precise location of the species seen, would be gratefully received. It is important, of course, not to disturb nesting birds; in most cases breeding can be proved without even approaching the nest.

A matter of habit

For most of us the daily round and the common task have become heavily overlaid by habit. The same old routines cope with repetitive work; the resources of labour, both individual and collective, are applied in well-worn grooves; and whilst sheer muscle power has now largely been replaced by technological ingenuity, all that has happened in perhaps the majority of instances is that we have simply acquired a new set of habits. Every now and then, therefore, it pays to ask the question: Why?—to challenge accepted practices (however hallowed) and consider whether some other method of doing a job or change in the organization might not save time, labour or money—or in fact all three.

Unlike industrial concerns, which are constantly reviewing their *modus operandi*, on the farm this is very much an individual investigation. No two farms are identical in the complex of their enterprises, location, capital investment and labour availability. Work study textbooks point to certain fundamental principles, and the Ministry's film, *Method Study in Agriculture*, which was made last year, has valuable object lessons. What it all comes down to in the end, however, is the farmer's own critical eye and his detection of where the moving parts may need lubrication for a sweetly running business. The potential for improvement always exists, though it may not be immediately apparent. But once questioned in the context of efficiency—or indeed whether the job or so many journeys around the farm, for example, are necessary at all—the answer may well be another question: 'Why didn't I think of that before?'

AGRIC

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Books

Aerial Photo-Ecology. JOHN A. HOWARD. Faber and Faber, 1970. £7

In writing a book which analyses all the topics which are pertinent to the aerial photographic evaluation of the biological environment, the author has set himself an immense task. The book is not therefore confined to the use of aerial photography in the study of small scale plant distributions as the title would suggest, but a survey of the techniques of aerial photography and air-photo interpretation as applied to ecological studies on the macro scale.

To enable the photo interpreter to more fully appreciate what he can see on an aerial photograph, the first 192 pages of this 325 page book are devoted to a review of the principles of aerial photography. A background into a wide range of topics pertinent to aerial photography is given, including such subjects as the camera, film, properties of light (with special emphasis on the reflection of light by vegetation), photogrammetry and stereoscopy. The virtues and limitations of the technique are analysed, and for the reader in Britain anxious to apply some of the knowledge gained from this book, it comes as a disappointment to read that in our situation there are probably only 20–25 days a year when conditions are suitable for black and white aerial photography.

The last section of the book is devoted to the integrated interpretation of the natural environment, starting with geologic and geomorphic considerations before proceeding to the study of the biological environment. Major emphasis is given to the use of aerial photography in forestry, as forestry and woodlands occupy one third of the world's land surface, and trees appear, whether by design or accident, on most aerial photographs. The author is also a specialist in forestry.

The agriculturist is not forgotten and will find in this book much of interest, particularly the sections on soils, plant diseases, agricultural and land utilization surveys. These sections are brief but the extensive bibliography allows the reader to follow up his interests elsewhere.

The book contains numerous figures, drawings and photographs, and a minor criticism is that the aerial photographs could be more clearly annotated. By omitting scale factors and flight dates from many of the photographs the reader will not make the best use of these illustrations.

Colour photographs are sparingly used, and the omission of an example of infra red colour (false colour) is a disappointment.

Dr. Howard is to be congratulated on producing a lucid reference book of value not only to students but to all those considering using aerial photography as a working tool.

J.G.T.

Joseph Arch. PAMELA HORN. Roundwood Press, 1971. £3·75

Social historians will be in no two minds about the considerable value of this first full-length biography of the man who above all others pioneered the way by which the agricultural worker would attain a higher status, the conditions of his employment, housing and general welfare brought within acceptable limits and today's National Union of Agricultural and Allied Workers foreshadowed. Hitherto, appreciation of Joseph Arch's work has rested solely on his autobiography, which in some respects must have guarded acceptance. Pamela Horn's recourse to additional sources and her objective assessment of the facts so elicited more clearly illumine the man and his work against the dark background of agrarian hardship, injustice and discontent which characterized nineteenth century England.

The rise of this Warwickshire-born boy, from bird-scarer and one-time hedger and ditcher to the position of the well-honoured Member of Parliament for North-west Norfolk, is the more remarkable since it was achieved in face of an hierarchy in which ordinary rural folk were completely subservient to the landed gentry and politically non-existent. Earlier, tentative attempts that had been made elsewhere to form district agricultural workers' unions had failed by reason of inbred apathy and lack of leadership. Not until the rally which Arch was invited to conduct on a wet February night in 1872 beneath the chestnut tree on Wellesbourne Green were the first firm steps taken that were to lead to a national union. In Joseph Arch, its first President and a Primitive Methodist preacher who could interpret and channel the thoughts of his audiences, the hour had found its man.

The ensuing confrontation of employers

and employed, the adversities against which the workers battled to relieve their poverty and the terminal shadow of the workhouse are well described by the author and, because of her freedom from emotion, is perhaps more effective than some other accounts of rural conditions at this time.

Early promise of the Union's success was not, however, to be fulfilled. By June 1874, its membership had reached its peak and this far below a majority of its potential. Rivalry between the national and a few local unions, personal hostilities and recrimination and, not least, the repercussions of the Eastern Counties lock-out steadily sapped the strength of the Union. Nevertheless, Arch continued to devote most of his time to its affairs throughout the second half of the decade, although his horizon was now widening on an essentially political front under a Liberal brief and a Gladstonian enthusiasm.

Josiah Sage, writing in 1951, declared 'Never before the days of Arch, nor yet since, have the ranks of the agricultural labourers produced such a man'. Pamela Horn's portrait preserves the same image down to the last detail of diligently ascertained fact.

S.R.O'H

Early Embryology of the Chick. Fifth Edition. Bradley M. Patten. McGraw-Hill, 1971. *£3·80.*

It has been said that to appreciate the abnormal one must understand the normal. Furthermore, to better know the applied it is valuable to be familiar with things basic. If one accepts these two concepts then the value of this book goes beyond its value to the student of early chick embryology. It becomes of interest and perhaps of use to the applied scientist and technician in the field of reproduction; not the sort of embryology for hatchery staff perhaps, but sound material for students of animal production, advisers and researchers, in addition to its basic and obvious use to students of embryology.

Starting, as embryology should, with the origins of the sex cells, it dwells usefully and significantly on oogenesis, spermatogenesis, sex determination and fertilization before proceeding to embryo development and taking the reader to the fourth day of incubation. It ends at the stage when some of us first become interested in 'embryology', at the stage when we can see an embryo—with blood vessels—plainly with the naked eye. However, days 5–21 are in a development sense somewhat simple when compared to the early hours of the chick embryo, and in its adequate treatment of these complicated early hours lies the value of this well written and beautifully-produced book. Particularly useful is the chapter devoted to the extra-embryonic membranes, a most important aspect of the embryological development of the chick. The coloured drawings based on wax-plate reconstructions are excellent aids to clarity in this exposition.

A bibliography of over 600 references classified into fourteen sections is another reason why this fifth edition of a volume born over fifty years ago must be a valuable aid to teacher, student and practitioner.

A.E.B.

An Atlas of Plant Structure. Vol. I. Brian Bracegirdle and Patricia H. Miles. Heinemann, 1971. £1·80.

It is unusual for one to look briefly at a new book and to decide at once that it must certainly succeed. This atlas is such a book. Primarily intended to assist the A-level and introductory degree course student in understanding the plant structures he sees on microscope slides, the work is also suitable for use in conjunction with botany courses in training colleges, farm institutes and the like.

Each subject is presented as a photograph which is accompanied by an explanatory drawing. The book scores over its competitors in the clarity of illustration. The extra cost of glossy paper is justified. Photographs are for the most part very good, and the execution of the line drawings of high standard. Drawings were made from the specimen itself, a process which gives far superior results to that involving inking over a photograph and then bleaching the photographic image away.

The first forty-six illustration pairs are of bacteria, algae, fungi, mosses and liverworts. Cell types are dealt with in 47–57; here the standard is not quite up to the mark and it is sometimes difficult to relate the drawing exactly to the photograph. 54, showing tracheids, has a fibre, unlabelled, in a prominent position. The illustration of a vessel element, labelled a vessel (58), is inverted with respect to the photograph. Tissues are covered in 59–69, shoot and root apices and mitosis in 70–75. Vegetative anatomy of subjects ranging from *Lycopodium* to *Drosera* (76–112) are followed by a similar range on reproductive organs, embryology and meiosis, in numbers 113–147.

One could make additional criticisms of points of detail, but these are slight and do not detract from the overall value of the book. The next volume will be awaited with interest. *D.F.C.*

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